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Lifetime Survivability of Contaminated Target-Chamber Optics *

F. Rainer, A. Anderson, A. Burnham, D, Milam, R. Turner
Lawrence Livermore National Laboratory
P. O. Box 5508, L-487
Livermore, CA 94551-9900

ABSTRACT

Target chambers used for Inertial Confinement Fusion (ICF) expose laser optics to a very hostile environment not only from high-fluence laser irradiation but also x-ray irradiation and particulate debris from targets and chamber wall materials. Expendable debris shields provide the first line of defense to more costly optics upstream in the laser beam path to contaminants generated within the target chamber. However, the replacement of a large number debris shields is also an expensive proposition so that extending their usable lifetime within the chamber is of crucial importance.

We have conducted tests to show that optics can both be cleaned and damaged by laser irradiation at 355 nm after being contaminated with potential chamber-wall materials such as B_4C and Al_2O_3. Such optics can survive from one to hundreds of laser shots depending on the degree of contamination and laser fluence levels. Similarly we have studied the survivability of optics that have been exposed to direct contamination from representative target materials irradiated in the target chamber as well as secondary exposure to both bare-polished and solgel-AR-coated fused-silica debris-shield samples.

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